

## PRACTICAL DENTISTRY

# Calaject - computer-controlled local anesthesia in pediatric dentistry

**Aneta Olszewska<sup>1</sup>, Katarzyna Cieślińska<sup>1</sup>, Barbara Biedziak<sup>2</sup>, Jerzy Sokalski<sup>3</sup>**

## **Calaject - computer-controlled local anesthesia in pediatric dentistry**

Reviewed paper

<sup>1</sup>Clinic of Diagnostics and Prevention of Developmental Anomalies of Masticatory Apparatus in Children, Department of Oral Surgery of Poznan University of Medical Sciences

Head: Aneta Olszewska M.D., PhD

<sup>2</sup>Laboratory of Developmental Facial Anomalies, Department of Oral Surgery of Poznan University of Medical Sciences

Head: Barbara Biedziak, M.D., PhD

<sup>3</sup>Department of Oral Surgery of Poznan University of Medical Sciences

Head: PUMS Professor Jerzy Sokalski, M.D., PhD

Corresponding author: Aneta Olszewska M.D., PhD

Department of Oral Surgery of Poznan University of Medical Sciences, Clinic of Diagnostics and Prevention of Developmental Anomalies of Masticatory Apparatus in Children, ul. Bukowska 70, 60-812 Poznań

ph. 618 547 053

e-mail: anetol@ump.edu.pl

### *Summary*

*It is well known that the effectiveness of dental treatment in children very often depends on pain free management. Administering local anesthetic injection may not only provoke anxiety in patients but also a kind of discomfort in the dentist performing the procedure. The paper evaluates the effectiveness and ergonomic properties of the injection apparatus Calaject (Ronvig) in children.*

**Index terms: Calaject, local anesthesia, children**

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## **Introduction**

One of the most difficult patients at the dentist's is a child whose lack of tolerance to stress and pain is so strong that it is often impossible to overcome during a single visit (1).

Performing a successful and painless dental procedure on a child is facilitated by local anesthetics which make it possible to control pain effectively. Currently, dentists have at their disposal a wide range of local anesthetics and methods of using them. However, despite the significant effectiveness of local anesthetics, often the injection itself is experienced by children as an extremely unpleasant and painful sensation. The strong fear of inserting a needle often makes it impossible to apply this method of reducing pain in young patients (2,3). At the same time, the psychogenic factor, which is strong stress and anxiety, may affect the degree of perception of pain and be one of the reasons for failure in obtaining complete anesthesia (1).

In the case of children, dental procedures frequently require time and patience to build a positive doctor-patient relationship. Undoubtedly, new apparatus for injections are convenient - computer-controlled local anesthetic delivery (CCLAD) devices which you can use to perform infiltration, conduction and periodontal ligament anesthesia with the possibility of slow administration of the anesthetic under low pressure and without using a syringe which arouses strong anxiety in children. Also the method of depositing the anesthetic is controlled electronically, so the pain during and pain sensation after injection is much smaller (4,5,6).

Adequate preparation of the child for a procedure and a proper anesthetic technique using patient-friendly methods for depositing anesthetics locally ensures the elimination of discomfort and, more importantly, it fosters the development of a positive attitude of the child's approach to dental treatment (5).

## **Aim of the study**

The aim of the study is a preliminary evaluation of the clinical effectiveness of computer anesthesia Calaject from the company Ronvig in pediatric dentistry.

## **Material and methods**

The study included 46 patients treated at the Clinic of Diagnostics and Prevention of Developmental Anomalies in Children of the Poznan University of Medical Sciences: 35 girls and 11 boys, aged from 5 to 17 years. It was planned to carry out the following dental procedures in this group, using the Calaject device for local anesthesia: extractions of primary and permanent teeth, procedures in soft tissues and conservative treatment of primary and permanent

teeth. These treatments were performed after administering computer-controlled local anesthesia: infiltration, conduction and periodontal ligament anesthesia.

In patients enrolled in the study there were no general or local contraindications for performing procedures in outpatient conditions.

The local anesthetic was 4% articaine solution - preparation Citocartin 100 (Molteni).

The subjective feelings of patients subjected to the study were evaluated based on a pre- and post-treatment questionnaire. The reactions of respondents observed during and after administering the anesthesia were evaluated, such as: the level of pain during injection of the needle, pain during deposition of the anesthetic and painfulness of the entire procedure based on the patient's behavior in relation to the Frankle's scale adopted for local anesthesia (Tab. 1).

In the questionnaire study, patients or their guardians compared the behavior of patients after administering the anesthesia using the Calaject apparatus with the traditional method or previous computer-controlled anesthetics according to the numerical scale from 1 to 10. Acceptance of the procedure was also asked about, whether they would like to be anesthetized using Calaject apparatus again.

The ergonomics of the device, comfort and ease of use by doctors performing procedures in the surveyed group were also evaluated (on a numerical scale from 1 to 10, where 1 = very bad, 10 = very good).

## **Results**

The following dental procedures were performed in the surveyed group using the Calaject apparatus: extraction of primary teeth – 15 and permanent teeth – 5, procedures in soft tissues – plastics of the upper and lower lip frenulum – 3 and conservative treatment of primary teeth – 8 and permanent teeth – 15.

The treatments were performed after administering computer-controlled local anesthesia: infiltration – in 30 patients, conduction – in 10 patients and periodontal ligament anesthesia – in 6 patients.

Among the respondents, 41 people (89%) were previously anesthetized locally, and among these 7 patients (17%) were provided computer-controlled local anesthesia previously (Wand apparatus).

The behavior of the patients evaluated according to Frankle's scale adapted to local anesthesia is shown in Tab. 2.

Behavior of patients during the administration of anesthesia was also evaluated. 38 respondents (83%) accepted the duration of injection, only for 3 patients (6%) it was too long and there was a change of behavior from positive (code 3) to negative (code 2). Refusal to cooperate concerned the youngest respondents (5-7 years old). The data obtained from guardians showed that these

children had had traditional local anesthesia performed with a syringe and ultimately did not allow the administration of the anesthesia (code 1).

According to the treating doctors, the time for administering anesthesia was acceptable for 44 patients (96%), only in 2 cases (4%) it was too long. The effective time of anesthesia was sufficient to perform the procedure in 45 people (98%), and only in 1 person (2%) it was necessary to administer an anesthetic again.

The feelings of patients during anesthesia are shown in Tab. 3. Patients were also asked about their feelings after administering the anesthetic. The results are presented in Table 4.

The effectiveness of computer-controlled anesthesia according to treating doctors, in relation to conventional anesthesia (on a scale from 1 to 10, where 1 = very bad, 10 = very good) is shown in Tab.5.

Among 41 people, in whom, according to the data from the interview, traditional anesthesia had been previously performed, anesthesia using the Calaject system was more acceptable for 36 people, and among 7 children who had been administered anesthetic using the computer-controlled Wand apparatus 5 reported no clear difference, and for 2 the performance of anesthesia using Calaject apparatus was more acceptable.

To the question on indicating preferred anesthesia during the next procedure, 39 people (85%) declared to use the Calaject apparatus again.

## **Discussion**

Fear of the syringe and needle that often occurs in children does not allow to achieve cooperation with the doctor and the possibility of painless dental treatment (7,8,9). Instead of a syringe, the sight of which usually causes tears and hysteria in children (code 4 according to Frankle), ergonomic computer-controlled devices for anesthesia appeared in which the dispensing element looks like a pen (Fig.1). In the opinion of doctors, the dispensing handle, in addition to eliminating fear of the patient, makes possible the ergonomic writing grip and high precision during injection.

Systems for computer-controlled local anesthesia available on the dental market include: Sleeper One S4(DHT France), Quicksleeper S4 (DHT France), Wand STA (Milestone Scientific, USA) and Anaeject (J.Morita Nashika Line, Japan) (10,11).

In this study we used the Calaject system, which consists of a touch panel, dispensing handle with a stand and foot control (Fig.2).

The Calaject device, thanks to 3 programs of controlled flow intensity of the anesthetic (selected from the touch panel), allowed to perform 30 infiltration anesthetics (program 2) in the surveyed group of patients, 10 conduction anesthetics (program 3) and 6 periodontal ligament anesthetics (program 1). Intelligent pressure control (IPC) causes automatic inhibition of depositing the

anesthetic when the pressure is too high, in order not to exceed the optimal rate of administering the drug. After selecting the program for the specific anesthesia (2 and 3) upon pressing the foot pedal the fluid begins to be deposited at a rate of 0.006 ml/s for 10 s, which was perceived favorably by patients, without the feeling of expanding pain. Then the speed increases to 0.03 ml/s. In the case of periodontal ligament anesthesia, the dispensing rate is 0.006 ml/s (10).

Patients evaluated this method of injections as painless and in most cases the administration time of the anesthesia was acceptable. In restless and impatient children, the sound signal seems helpful, which lets the patient stay calm or distract the child from the time of application e.g. by counting down the signal duration. The emitted signal caused that respondents concentrated on the device without paying attention to the procedure that was being performed by the doctor.

It should also be emphasized that slow and precise deposition of fluid does not cause extensive anesthesia of surrounding tissues, which in traditional anesthesia often causes anxiety in the child, crying and refusal to cooperate (code 1 according to Frankle) (12,13). Patients could freely talk with the doctor or guardian about what they were feeling, which were not assessed as disturbing or unpleasant.

In the case of children who are beginning to show impatience during slow administration of the anesthetic it is possible to increase the rate up to 0.04 ml/s by pressing the foot pedal and shortening the time of injection.

In *Hochman's* reports, who compares the sensations of patients during injections performed with a traditional syringe and CCLAD type apparatus, significantly lower feelings of discomfort and pain accompanied an electronically-assisted injection (13,14,15). Studies conducted among patients aged from 5 to 13 by *Gibson* et al. showed that during anesthesia performed with a computer-controlled apparatus, children are calmer, they do not make sudden movements and it is a less painful method for smaller patients (16).

Willingness of another anesthetic using the Calaject apparatus declared by respondents indicates the acceptance of this type of anesthesia by children, who provided a positive and definitively positive attitude (code 3 and 4 according to Frankle). Guardians also appreciate the comfort of anesthesia and painless procedure, which encourages children to subsequent visits at the dentist's office (17,18). Previous experience with traditional anesthesia were associated with fear of the syringe and needle, pain during injection and unpleasant feelings after the deposition of anesthetic, which ultimately led to the lack of cooperation of the child and made it impossible to carry out proper treatment or impaired contact with the child during the next visit (code 1,2 according to Frankle) (19).

## Summary

Using computer-controlled local anesthesia in pediatric dentistry has no contraindications, they concern only the anesthetic and local conditions like periodontal disease (like in the case of traditional anesthetics using a syringe).

The high degree of acceptance of the procedure and feelings after the deposition of the anesthetic by demanding patients like children makes it possible for a doctor to carry out dental treatment in this age group, where treatment needs, as everyone knows, are considerable, in a painless and comfortable way.

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TABLE 1. Frankle's behavioral scale adapted to local anesthesia

Behavior	Code	Description
Definitely negative	1	Refusal to have anesthesia administered, crying, screaming, covering the mouth
Negative	2	Avoiding the administration of anesthesia, loss of cooperation after administering the anesthesia
Positive	3	Acceptance of having anesthesia administered, cautious attitude or controlled anxiety
Definitely positive	4	Interest in the procedure, good cooperation, smile

TABLE 2. Behavior of patients evaluated before, during and after administering the anesthesia using Calaject

Behavior	Code	Number of respondents (%)
Definitely negative	1	0
Negative	2	3 (6%)
Positive	3	38 (83%)
Definitely positive	4	5 (11%)

TABLE 3. Subjective feelings of patients during injection (reported by respondents/guardians or observed change in their behavior according to Frankle's scale adapted to local anesthesia)

Sensations during the administration of anesthesia	Girls Number, %	Boys Number, %	Total Number, %
Pain	0	2(4%)	2(2%)
Tingling	3(6%)	8(17%)	11(24%)
Slight discomfort	2(4%)	5(11%)	7(15%)
Acceptable discomforts	3(6%)	5(11%)	8(17%)
No discomforts	30(65%)	11(24%)	41(89%)

TABLE 4. Subjective feelings or changes in behavior occurring immediately after injection

Sensations after injection	Girls Number	Boys Number	Total Number, %
Immediate effect of anesthesia	20	15	35(76%)
No effect of anesthesia	0	1	1 (2%)
Strong anesthesia of surrounding tissues	3	4	7 (15%)
Long-term soft tissue anesthesia	2	3	5 (11%)

TABLE 5. Effectiveness of Calaject anesthesia as assessed by doctors

Assessment	1	2	3	4	5	6	7	8	9	10
Number of treatments	0	0	0	0	0	0	0	12 (26%)	20 (43%)	14 (31%)

*Podpisy pod zdjęciami:*

Fig. 1. Pen-like handle (dispensing tip) vs traditional syringes

Fig. 2. Calaject System